

Chemotherapy Safe Handling Practice and Associated Factors among Nurses Working in Hemato-Oncology Unit in Addis Ababa Public Cancer Treatment Centers, Addis Ababa, Ethiopia: A Cross-sectional Study

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Abstract

Background

Nurses are potentially exposed to antineoplastic agents in their practice. Exposure to antineoplastic agents is associated with adverse outcomes. Using Safe handling measures reduces the potential for adverse outcomes. Despite existing recommendations, adherence to safe chemotherapy measures is below the recommended levels. Even though this study sought to assess practices of safe handling of chemotherapy among hematooncology Nurses in cancer treatment centers in Addis Ababa, Ethiopia.

Objective

To assess the practice of chemotherapy safe-handling and associated factors among hemato-oncology nurses working in Addis Ababa public cancer treatment centers, Addis Ababa, Ethiopia, 2024.

Methods

A population census was conducted in which all nurses (219) working in public cancer treatment centers were included, and an institution-based cross-sectional study was used. Data were entered using Epi-Data version 4.1 and exported to SPSS version 25.0 for data cleaning and analysis. To examine the relationship between the outcome and independent variables, factors with a p-value < 0.20 in binary logistic regression analysis were run for subsequent multivariate analyses. A variable that had a statistically significant association with the outcome variable ($P < 0.05$) was reported as an associated factor by using AOR with 95% confidence interval (CI).

Results

219 respondents participated with a response rate of 93.2%. 52.5% of nurses had good chemotherapy safe handling practices, and 67.5% had good knowledge of safe chemotherapy handling practices. Three predictor variables were significantly associated with chemotherapy safe handling practice, such as: less than one year of experience (AOR = 6.4, 95% CI: 8.91–11.10), training about chemotherapy safe handling (AOR = 4.83; 95% CI: 3.1–8.1), and access to policies and procedures regarding safety (AOR = 3.36, 95% CI: 1.24–10.61).

Conclusion

Chemotherapy safe handling practice was moderate. Years of experience, training in chemotherapy safe handling, and access to policies and procedures regarding chemotherapy safety practices were significantly associated with Chemotherapy safe handling practices. Therefore, it is crucial to provide

periodic training, access policies and procedures regarding safe chemotherapy handling, and replace nurses with less than one year of experience with nurses who have more years of experience.

1. Introduction

Safe handling of chemotherapy practice is crucial to protect healthcare workers and patients. It includes preparation, administration, transferring drugs, cleaning spills, disposing of empty vials and bags, and handling patient excreta, all according to standard guidelines and precautions (1).

The main argument is that proper safe handling of chemotherapy is essential to minimize health hazards among nurses and other healthcare workers due to the widespread use of chemotherapy drugs. Despite this necessity, more than five and a half million healthcare workers worldwide are at risk of exposure largely because safe handling measures are not consistently used (2, 3, 4).

Cancer is an emerging public health problem in Africa, and about 715,000 new cancer cases and 542,000 deaths occurred in 2008, with these numbers expected to double in the next 20 years. The rising number of patients leads to an increase in the use of chemotherapy drugs [CDs] and so many more possibilities of exposure of the healthcare workers to these drugs. The number of staff potentially exposed to the hazardous effects of the chemotherapy drug was more than 5.5 million(5).

Chemotherapeutic agents are known to be carcinogenic, teratogenic, and mutagenic to humans. Occupational exposure to chemotherapeutic agents is a potential risk. Healthcare workers, especially nurses who prepare and administer chemotherapeutic drugs, may experience the cytotoxic effects of the drugs through direct skin contact, respiratory and digestive system exposure, and these effects are vital to human life(5, 6). Chemotherapy Safe handling practices include the use of safety equipment, work practices, and effective use of PPE. Following the international and national precaution guidelines consistently can decrease occupational exposure to hazardous drugs(7).

Even if there is an increased clue and information related to the issue of safe handling of chemotherapy drugs, many health care workers still do not use safe chemotherapy handling practices in the health care settings and are not under the implementation of appropriate safety measures (8). Findings from different studies revealed that health care workers are exposed to anti-neoplastic drugs during compounding, administration, cleaning of the working area, and disposal of cytotoxic drugs because of inappropriate handling practices(9).

Even though there are undesired side effects related to the handling of anti-neoplastic drugs, following safe handling measures can reduce the unwanted effects of those drugs. Different guidelines and protocols have been developed to improve the safe handling of cytotoxic drugs and protect health care workers who handle those drugs against their potential adverse effects (4, 10, 11, 12). The best way to protect workers from a hazardous exposure is by elimination or substitution of the hazard, but this is not feasible with drug therapy(13).

Despite the availability of international guidelines for chemotherapy handling, adherence to safe measures is below expectations. Although guidelines for safe handling of CDs were introduced more than 20 years ago, contamination of both the working environment and the Health Care Workers is still reported in several recent studies, particularly in developing countries(14).

Risk/influencing factors that affect chemotherapy safe handling practice identified were unsafe working environment, number of patients treated, knowledge, attitude, educational level, availability of safety measures and guidelines, and nurses' characteristics(15). This study examined safe-handling practice and associated factors among hematoma-oncology nurses working in Addis Ababa public cancer treatment centers.

2. Methods

2.1. Study design and setting

An institution-based cross-sectional study was conducted at Tikur Anbessa Specialized Hospital (TASH), Saint Paul's Hospital Millennium Medical College (SPHMMC), Yekatit 12 hospital, and Zewoditu Memorial Specialized Hospital from 01 March to 01 June, 2024.

The study was conducted in Addis Ababa, which is the capital of Ethiopia and the headquarters of different national and continental organizations. It is estimated that the city has 5,641,000 inhabitants. TASH, SPHMMC, Yekatit 12 hospital, and Zewoditu Memorial hospital are hemato-oncology centers in Addis Ababa. These hospitals offer diagnosis and treatment for approximately 370,000- 400,000 people per year. The provided service includes; Anti neoplastic drugs, surgery, and radiotherapy for non-Hodgkin's lymphoma and other malignancies with limited material and personnel resources. The hematology department offers services for nearly 15,800 blood cancer patients per annum (16).

2.2. Sample size determination

A population census was conducted to include all study subjects since the total population underestimation of the sample was 235 nurses at four hospitals who work in hemato-oncology units.

2.3. Subjects

All nurses working in the hemato-oncology unit in Addis Ababa public cancer treatment centers. All nurses working in the hemato-oncology unit for more than 6 months in Addis Ababa public cancer treatment centers from March 1 to June 1, 2024, were included in the study.

2.4. Data collection

An observational checklist was used to collect data for practice items and knowledge by using self-administered questionnaires. The checklist is adapted from previous literature (25). The checklist has three parts. Part I: sociodemographic characteristics of the nurse, Part II: safe chemotherapy handling practice, which has four subparts, Part IIA: preparation, Part IIB: administration, Part IIC: disposal, and

Part IID: cleaning chemotherapy preparation area and spills, and Part III: factors associated with safe chemotherapy handling practice. Two BSc nurses were recruited to collect the data.

Data quality was maintained before, during, and after data collection. Training was given for data collectors by the principal investigator. At the end of each day, the questionnaire was checked for completeness of each question. The reliability of the instrument was identified by calculating Cronbach's alpha using SPSS version 25.0. And it was 7.2. Senior experts in the area of study for content validity examined the data extraction tool. The entire data collection process was closely supervised by the supervisors and the principal investigator.

2.5. Data analysis

Data were entered using Epi-Data version 4.1 and exported to Statistical Package of Social Science (SPSS) version 25.0 for data cleaning and analysis. Once the data was entered, basic quality assurance measures, including data cleaning using browsing of data tables after sorting, frequency distributions, cross-tabulations, summary statistics, and statistical outlier detection, were performed. Descriptive statistics were used for categorical variables and mean $\pm$ SD (standard deviations) for continuous variables. Continuous variables were categorized using information from the literature, and categorical variables were re-categorized accordingly. The outcome variable (chemotherapy safe handling practice) was categorized to binary type (good and poor practice). A statistical technique called the variance inflation factor (VIF) was used to test multicollinearity between covariates, and a VIF > 10 is considered multicollinearity. Binary logistic regression analysis was carried out to examine the relationship between the outcome variables and independent variables. To check the adequacy of the final model, the Hosmer–Lemeshow goodness-of-fit test was performed. Independent variables for which p -value < 0.20 in binary logistic regression analysis were run for subsequent multivariate analyses using logistic regressions. A variable that had a statistically significant association with the outcome variable (P < 0.05) was reported as an associated factor by using AOR with 95% confidence interval (CI). Finally, the results were summarized and presented in tables, charts, and graphs.

3. Results

3.1. Sociology-demographic traits of the respondents

A total of 219 participated in this study, giving a response rate of 93.2%. Almost one third (68.5%) of the respondents were in the 25–30 age group. More than half, 116(53%) of the participants were males. With regard to the educational status of nurse 145(66.2%) had a bachelor's degree, and 66(30.1%) masters. With regard to marital status, almost half, 108(49.3%), were single and 105(47.9%) were married, the rest 6% are widowed and separated. regarding to their work experience the majority108((49.3%) of nurse were > 5-year experience and 17(7.8) nurse are less than one year work Experience. Among 149(68%) nurse was taken training about chemotherapy safe handling, 98(47.8%) of nurses had received training less than in the last 12 months (Table 1).

Table 1

Socio-demographic characteristics of the nurses working in hemato-oncology centers towards safe chemotherapy handling in Addis Ababa public cancer treatment centers, Addis Ababa, Ethiopia, 2024 (n = 219)

Variable	Category	Frequency	Percent
Age	20–30	150	68.5
	31–40	62	28.3
	> 40	7	3.2
Sex	Male	116	53
	Female	103	47
Educational level	Diploma certificate	8	3.7
	Degree	145	66.2
	Master	66	30.1
Year of experience	< 1 year	17	7.8
	1–3 year	50	22.8
	3–5 years	44	20.1
	> 5 years	108	49.3
Marital status	Single	108	49.3
	Married	105	47.9
	Widowed	5	2.3
	Separated	1	0.5
Have you train on safe chemotherapy handling	Yes	149	68
	No	70	32
When do you take your last training?	< 12 month	51	34.2
	> 12month	98	65.7

3.2. Knowledge of nurse towards chemotherapy safe handling practice

The assessment of safety awareness revealed that 67.5% of the surveyed healthcare professionals had good knowledge of safe chemotherapy handling practices (Fig. 1).

3.3. Organizational and individual factors

The majority, 212(96.8%) of nurses are preparing chemotherapy during the daytime, the rest were preparing at night time. Almost half (52.1%) of the working area had chemotherapy safe handling precautions. In the majority of 142 (64.8%) of working area the supervisors did not ensure nurse protection from chemotherapy (Table 2).

Table 2
organization and individual factors chemotherapy safe handling In Addis Ababa public cancer treatment
centers, Addis Ababa, Ethiopia, 2024(n = 219)

Variables	Category	Frequency	Percent
The time you prepare chemotherapy	Day	212	96.8
	Night	7	3.2
Is there chemotherapy safe handling precaution guideline in your working unit	Yes	114	52.1
	No	105	27.9
Are there supervisors on unit to insure nurses' protection from exposure to chemotherapy	Yes	77	35.2
	No	142	64.8
Is there opportunity to be properly trained to use personal protective equipment so that you can reduce chemotherapy exposure.	Yes	115	52.5
	No	104	47.5
Is there conflict within your work area	Yes	90	41.1
	No	129	58.9
Numbers of days chemotherapy administered pre week	1	24	11
	2	34	15.5
	3	33	15.1
	> 3	128	58.4
has separate room designed for procedures of chemotherapy preparation	Yes	133	60.7
	No	86	39.3
Numbers of patient's chemotherapy given per your shift	< 4	43	19.6
	> 6	176	80.4
Are there proper PPE available in work setting	Yes	117	53.4
	No	102	46.6
Is chemotherapy preparation room and administration room nearby	Yes	121	55.3
	No	98	44.7
Is The work area is kept clean	Yes	138	63
	No	81	37
Is the work area is not crowded	Yes	57	26
	No	162	74

Variables	Category	Frequency	Percent
Have you access to policies and procedures regarding safety	Yes	75	34.2
	No	144	65.8

3.4. Practice on chemotherapy safe handling

The practice of chemotherapy safe handling was measured using an observational checklist with four categories: preparation, administration, disposal, and cleaning spills during preparation. Each part of the practice category has common safe measures and has also unique precaution measures, and in addition to this, they have different importance.

3.4.1 Preparation /compounding of chemotherapy

Almost one third of 142(64.8%) of nurses are using a biological safety cabinet to prepare chemotherapy. Whereas half of nurses 115(52.5%) were not using closed system transfer device,197(92.2%) wear gown, regarding to re- use disposable gown 156(71.5%) (Table 3)

Table 3

Safe measures to preparation /compounding of chemotherapy nurses working in hemato-oncology centers towards safe chemotherapy handling (n = 219) in Addis Ababa public cancer treatment centers, Addis Ababa, Ethiopia, 2024.

Variables	Category	Frequency	Precent
Use Biological Safety Cabinet (BSC)	Yes	142	64.8
	No	77	35.2
Use Closed system transfer device	Yes	104	47.5
	No	115	52.5
Done Gown	Yes	202	92.2
	No	17	7.8
re-use disposable gown	Yes	156	71.2
	NO	63	68.8
Done Gloves/ double glove	Yes	197	90
	No	22	10
Done Google/face shield	Yes	163	74.4
	No	56	25.6
Use Head cover	Yes	175	79.9
	No	44	20.1
Done Surgical mask	Yes	190	86.8
	No	29	13.2
Done N95 mask	Yes	204	93.2
	No	15	6.8
Done Overshoes	Yes	51	23.3
	No	168	76.7
Change torn gloves immediately.	Yes	188	85.8
	No	31	14.2
wipe vials or ampules after removing the outer packaging material before reconstituting	Yes	113	51.6
	No	106	48.4
wash hands before preparing chemotherapy	Yes	127	58
	No	92	42

Variables	Category	Frequency	Precent
change glove every 30 minute during preparation	Yes	124	56.6
	No	95	43.4

3.4.2. safe measures to Administration chemotherapy

Regarding administration of safe measures, chemotherapy nurses had a high frequency of using closed system transfer device 183(83.6%), washing their hands after removing of PPE 170(77.6%), donning gloves 151, 68.9%), Surgical mask 198, 90.4%), and using an N95 mask 133, 60.7%). On the other hand, nurses had high malpractice of re-using PPE used on the previous days, 140 (63.9) %, didn't use overshoes 178(75.8%), didn't use Google/face shield 110(50.2%).

3.4.3. Disposal of chemotherapy

During the disposal of chemotherapy medication majority 158(72.1%) of nurses were wearing gowns, and also the majority were using reusable disposable gown 112(51.1%). The majority, 179(81.7%) of nurses working in the oncology unit wash their hands after removing PPE, and also 144 (65.8%) are segregating chemotherapy drugs before disposal (Table 4).

Table 4
safe disposal of chemotherapy medication among nurses working in hemato-oncology centers towards safe chemotherapy handling (n = 219) in Addis Ababa public cancer treatment centers, Addis Ababa, Ethiopia, 2024.

Variables	Category	Frequency	Precent
Gown	Yes	158	72.1
	No	61	27.9
Re use disposable gown	Yes	112	51.1
	No	107	48.9
Gloves/ double glove	Yes	136	62.1
	NO	83	37.9
Google/face shield	Yes	132	60.3
	No	87	39.7
Head cover	Yes	156	71.2
	No	63	28.8
Surgical mask	Yes	183	83.6
	No	36	16.4
N95 mask	Yes	136	83.6
	No	83	16.4
Overshoes	Yes	55	25.1
	No	164	74.9
change torn gloves immediately.	D	186	84.9
	No	33	15.1
Wash hands after removing your PPE	Yes	179	81.7
	No	40	18.3
segregate chemotherapy drugs before disposal	Yes	144	65.8
	No	75	34.2

3.4.4. Cleaning chemotherapy preparation area/ chemotherapy spills

Regarding PPE use during spill cleaning majority of nurses 183(83.6%) used Gown when they clean spills of chemotherapy. Almost half of the nurses, 113 (51.68%), working in the oncology unit were

reporting using a chemotherapy spill kit in the working area, and also the majority of nurse 138(63%), were using an N95% mask to clean the chemotherapy preparation area. During cleaning of spills, more than half of nurses, 114(52.1%), used reusable disposable Gowen. Regarding the use of reagent and technique of spill cleaning, 147(61.7%) use cleaning reagents to clean the preparation area, 157(67.1%) clearly demarcate the chemotherapy spill area before cleaning, and 155(70.8%) began outside the spill area and gradually move towards the center.

Practice of safe chemotherapy handling

The overall mean of practices was 1.34, and it was calculated by summing up all item responses during preparation, administration, cleaning preparation area, spills, and disposal of chemotherapy. Those who scored less than 1.34 were considered to have poor practice, and scoring greater than 1.34 were considered to have good practice. 115(52.5) are good practices of chemotherapy safe handling, and 104(47.5%) nurses had poor practices of chemotherapy safe handling (Fig. 2).

3.5. Associated factors of chemotherapy safe handling practice

Fifteen predictor variables were used in the bi-variate analysis, and eight variables having a P value of < 0.20 were entered into the multivariate logistic regression model. Finally, three variables were significantly associated with chemotherapy safe handling practice such as: less than one year of experience (AOR = 6.4; 95% CI; 8.91–11.10; P-value < 0.001), training about chemotherapy safe handling (AOR = 4.83; 95% CI; 3.1–8.1; P-value < 0.001), and access to policies and procedures regarding safety (AOR = 3.36, 95% CL: 1.24–10.61, P-value = 0.018) are significant associated factors of practices of chemotherapy safe handling. Nurse who was less than one year of experience was 6.4(8.91–11.10) times more likely to practice chemotherapy safe handling than more than five years of experience. Nurses who received training about chemotherapy safe handling were 4.83(3.1–8.10) times more likely to have good chemotherapy safe handling practice than their counterparts, and access to policies and procedures regarding safety was 3.63 times more likely to have good practices of safe chemotherapy handling than those who lacked access to it (Table 5).

Table 5
Bivariable and multivariable logistic regression analysis to identify factors for chemotherapy safe handling practice(n = 219)at oncology centers,Addis Ababa,Ethiopia,2024

Variables	Category	Practice		COR (95% CI)	AOR (95%CI)	p-value
		Good	poor			
Sex	Male	48	68	0.59(0.347–1.01)	1.16(0.478–2.82)	0.743
	Female	56	47	1	1	
Experience	< 1 year	15	2	7.78(6.20–12.59)	6.4(8.91–11.10) *	0.001
	1–3 year	25	25	1.04(0.49–1.8,0.914)	2.88(0.98–8.5)	0.55
	3–5 year	22	22	1.08(0.478–1.9)	2.63(0.86–0.86)	0.8
	> 5 year	53	55	1	1	
Training	Yes	76	38	3.38(1.95–6.26)	4.83(3.1–8.1) *	0.001
	No	39	66	1	1	
chemotherapy safe handling practice guideline	Yes	38	76	0.24(0.17–0.51)	1.76(0.66 – 0.468)	0.83
	No	66	39	1	1	
supervisors on your unit to insure nurses' protection from exposure to chemotherapy (1)	Yes	20	57	1	1	
	No	84	58	0.24(0.132–0.446)	1.31(0.38–4.53)	0.61
Have you an access to policies and procedures regarding safety	Yes	12	63	0.11(0.053–0.128)	3.63(1.24–10.61)*	0.08
	No	92	52	1	1	
Opportunity to get proper training about PPE	Yes	40	81	1	1	
	No	68	30	0.02(0.13–0.39)	1.73(0.71–4.1)	0.22
Is work area crowded	Yes	86	83	1.84(0.96–3.5)	1.25(0.37–1.25)	0.7
	No	18	32	1	1	
Is there proper PPE in work setting	Yes	40	77	1	1	
	No	64	38	0.31(0.18–1.54)	1.51(0.59–3.80)	0.38

4. Discussion

This study revealed that 52.5% of nurses had good practices on safe chemotherapy handling, which is less than a study done in Lahore, Pakistan, which was 76% of nurses working at the oncology center was good practices of chemotherapy safe handling (17), Saint Tukdoji Maharaj Cancer Hospital in Indian which is 74% (18). The discrepancy might be variation in sample size in the current study the numbers of study participants were 219 whereas in case of the previous study it was 127 and 187 respectively in addition to this there might be variation in data collection too¹ in the current study observational checklist were used however in the previous studies self-administered questionnaires were used that will inflate the magnitude of good practice. However, the current study finding is higher than a study at Minia University in Egypt(19), where only (26.0%) had good practice on chemotherapy safe handling. The discrepancy might be due to differences in sociodemographic factors and nurses' behavior.

With regard to the factors of safe chemotherapy handling practice, year of experience, training about chemotherapy safe handling, and access to policies and procedures regarding chemotherapy safe handling were significantly associated with practices of chemotherapy safe handling.

Based on the study finding nurse who had less than one year of experience were 6.4 times more likely to use safe measures of chemotherapy handling than those with five years or more of experience. This study was a result to study done in Jordanian Oncology Nurses (20). However, it is contradicted by a study done at Saint Tukdoji Maharaj Cancer Hospital, Nagpur, India nurse with increased years of experience had better practice than their counterparts (18). This might be a difference in nurse behavior and proportional difference in experience who work on the unit, and in addition to this, it might be due to the fact that newer nurses will fear the toxic effect of chemotherapy and will adhere well with safe measures, and those nurses having more years of experience have adopted the environment and will not adhere with safe practices.

Regarding training about chemotherapy safe handling practice nurse who had training (AOR = 4.83, 95%CL:3.1–8.1,0.001) had 4.83 good practice than those who had no training. This study had similar findings with a study conducted in Zagazig University hospitals in Egypt(21) on the practice of chemotherapy safe handling among nurses. This might be that as the nurse receives training, they would gain new information, which increases their likelihood of good practice on safe handling of chemotherapy. In addition to this, access to policies and procedures was 3.36 times more likely to have good practice than their counterparts (AOR = 3.36,95%CL:1.24–10.61, P-value = 0.018). This study is supported by a study conducted at Tertiary Care Hospital in Karachi, Pakistan(9). This is the fact that availability and access to policies and procedures in the unit guide the nurse on how to safely practice chemotherapy handling during preparation, administration, disposition, and cleaning of spills.

Limitation of the study

This study used a cross-sectional design, so it cannot determine cause-and-effect relationships, only associations at one point in time. Additionally, the use of observation and self-reported data may have

influenced nurses' behavior or responses, potentially leading to an overestimation of safe chemotherapy handling practices.

Conclusions

Chemotherapy safe handling practice was low among nurses working in the hemato-oncology unit compared with other studies conducted in different countries. Years of experience, receiving training on chemotherapy safe handling practice, and having access to policies and procedures regarding chemotherapy safe handling were significantly associated with chemotherapy safe handling practices. Safe chemotherapy handling is crucial, and nurses can avoid issues for both themselves and their patients. Effective actions are required to improve the safe handling of chemotherapy by nurses working in an oncology center. Training about chemotherapy safe handling practice and increasing access to policies and procedures regarding chemotherapy safe handling practice were very important to increase good practices of chemotherapy handling.

Declarations

Ethical approval and consent to participate

Ethical clearance and approval for the study were obtained from the research review and ethics committee of SPHMMC. Permission to conduct the study was also obtained from Tikur Anbessa Specialized Hospital, SPHMMC, Yekatit 12 Hospital, and Zewditu Specialized Memorial Hospital. Participants were informed about the objective of the study, and informed written consent was obtained from all study participants. The names of the respondents or any personal identifier were not included during data collection to guard the Privacy, confidentiality, and anonymity.

Consent for publishing

'Not Applicable'

Competing interests

There are no competing interests among the authors.

Availability of data and materials

Data and materials are available and can be shared by the corresponding author.

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Authors' contributions

Design and conception of the study: SA, WF, MT, GA and AD; Performed the study: WF, AD, MI, HS, GM, SA, and ; Data analysis and interpretation: SA, WF, ; Writing of the manuscript: AD, WF; All the authors have read and approved the final manuscript.

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Figures

Knowledge towards chemotherapy safe handling practice

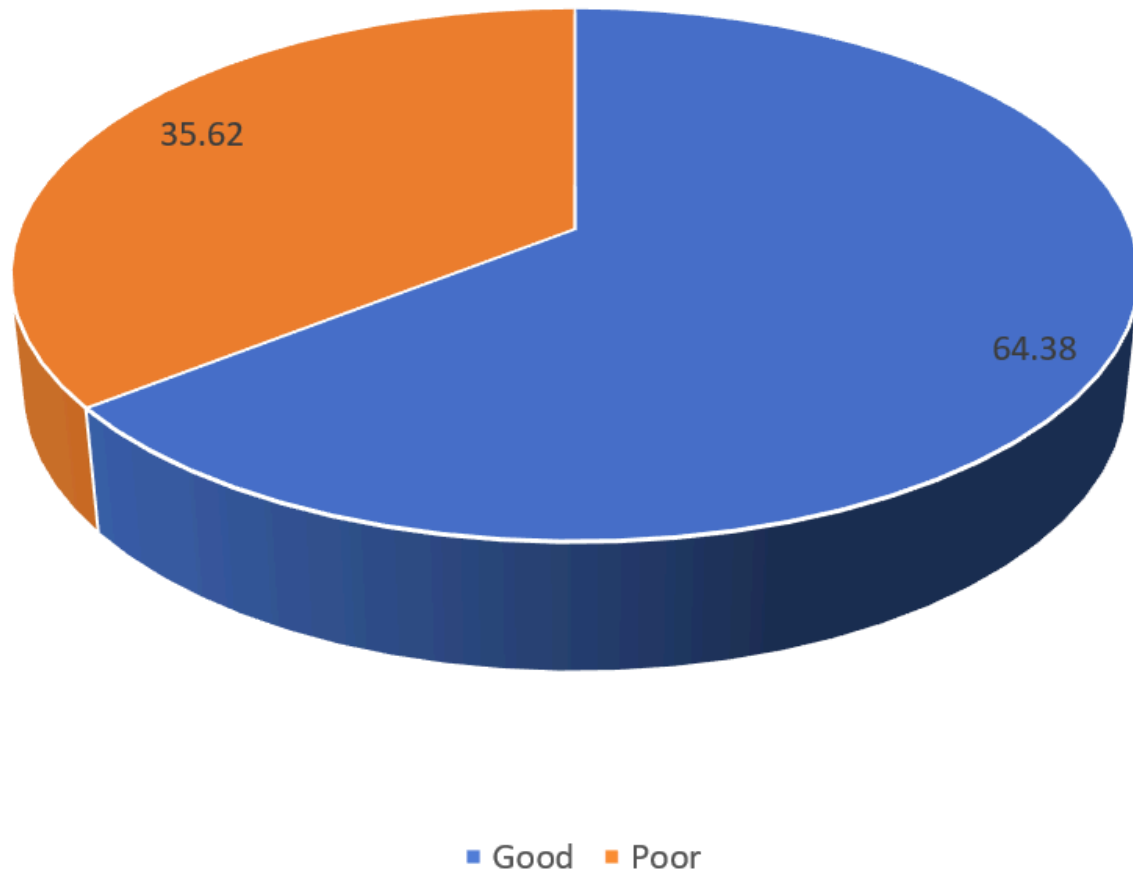


Figure 1

Knowledge of nurse towards chemotherapy safe handling practice In Addis Ababa public cancer treatment centers, Addis Ababa, Ethiopia, 2024

Overall mean practice of nurse towards safe chemotherapy handling

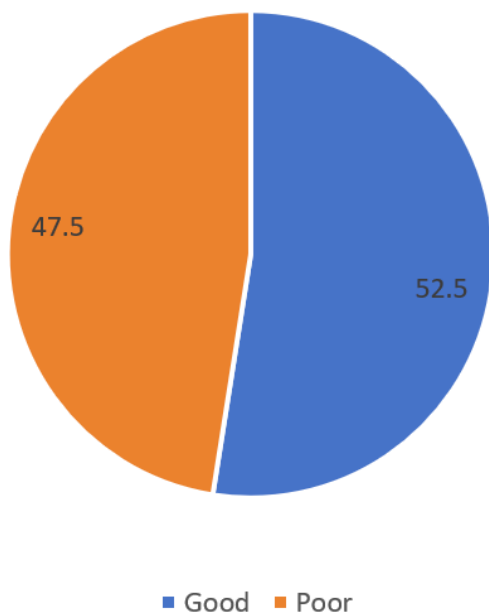


Figure 2

Practice of nurse towards chemotherapy safe handling practice In Addis Ababa public cancer treatment centers, Addis Ababa, Ethiopia, 2024